

REMARKS

Please cancel claims 3, 6 and 7. Claims 1-2, 4-5 and 8-16 are pending.

Applicants have limited the claims to include one or more aluminoxane compounds as part of the catalyst system. Support for this amendment can be found in previous claim 6 and at page 8, line 45, of the specification. Applicants have also added the limitation of previous claim 3 to claims 1 and 2.

Claims 1-5, 7, 9 and 10 stand rejected under 35 U.S.C. 103(a) as being unpatentable over JP 10-231317 to Tani et al. in view of U.S. 5,576,263 to Badley et al. Applicants have added the limitation of previous claim 6 to the main claims, thereby overcoming this rejection.

Claims 1-6 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Koehn et al. (Abst. ACS, 1997) in view of Badley et al. Applicants respectfully traverse this rejection. "The totality of the prior art must be considered, and proceeding contrary to accepted wisdom in the art is evidence of nonobviousness." MPEP 2145 X.D.3.

In the present case, copolymers produced by the processes of instant claims 1 and 2 have an unexpectedly narrow molecular weight distribution (M_w/M_n). For example, Tani et al. teaches, that when using boranes and chromium complexes at the usual polymerization time of 1 hour, mostly polymers with a low molecular weight are obtained (see Table 1, examples 3, 4, 5, 6). The predominant products produced with Tani et al.'s catalyst complex are C₄-C₁₄ oligomers and the molecular weight distribution is broad.

The Theopold et al. reference newly cited by the Examiner shows that the

chromium compounds therein give polymers with very broad molecular weight distributions. This also occurs when using triazacyclohexane chromium compounds which have, for example, oxygen attached to the chromium (see examples 18 and 19, page 25 and 26 of the instant application) or if the wrong kind of activator is used (see example 31, page 25, 26, wherein borate is used).

The chromium catalysts of Badley et al. also lead to a broad molecular weight distribution (M_w/M_n above 10) (see Table 5). Also, Koehn et al. has no teaching regarding the molecular weight distribution of the polymer obtained.

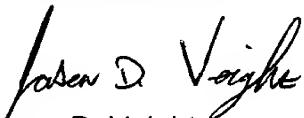
Only with the claimed combination of complexes and activator, could the copolymers with a narrow molecular weight distribution, high comonomer content and high molecular weight be obtained. Such properties would not have been expected from the teaching of the prior art which actually leads away from the present invention. Therefore the present invention would not have been obvious.

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MIHAN et al., Ser. No. 09/937,780

Respectfully submitted,

KEIL & WEINKAUF

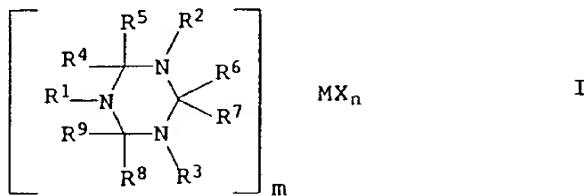

Jason D. Voight
Reg. No. 42,205

1350 Connecticut Avenue, N.W.
Washington, D.C. 20036
(202) 659-0100

IN THE CLAIMS

1. (currently amended) A process for copolymerizing ethylene or propylene with one another or with other olefinically unsaturated compounds, which comprises carrying out in the polymerization in the presence of a catalyst system which comprises the following components:
 - A) a complex of a transition metal with one or two substituted or unsubstituted 1,3,5-triazacyclohexane ligands, and
 - B) if desired one or more aluminoxane activator compounds,

wherein the component (A) is a compound of the formula I



in which:

M is a transition metal of groups 4 to 12 of the Periodic Table.
R¹-R⁹ are hydrogen or organosilicon or organic substituents having from 1 to 30 C atoms, it being possible for two geminal or vicinal radicals R¹ to R⁹ radicals also be connected to form a 5- or 6-membered ring, and it being possible, when m is 2, for an R¹-R⁹ radical of in each case one triazacyclohexane ring to form together with a substituents on the other

triazacyclohexane ring a bridge between the two rings.

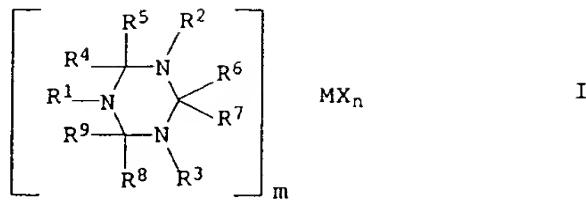
X is fluorine, chlorine, bromine, iodine, hydrogen, C₁-C₁₀-alkyl, C₆-C₁₅-aryl or alkylaryl having from 1 to 10 C atoms in the alkyl radical and from 6 to

20 C atoms in the aryl radical, trifluoroacetate, BF₄⁻, PF₆⁻ or bulky noncoordinating anions,

m is 1 or 2,

n is a number from 1 to 4 which corresponds to the oxidation state of the transition metal M.

2. (currently amended) A process for copolymerizing ethylene or propylene with one another or with other olefinically unsaturated compounds at from 20 to 300°C under pressures from 5 to 4000 bar, which comprises the following steps:
 - a) contacting a complex of a transition metal with one or two substituted or unsubstituted 1,3,5-triazacyclohexane ligands (A) with at least one aluminoxane activator compound (B),
 - b) contacting the reaction product from step (a) with the olefinically unsaturated compounds under polymerization conditions
wherein the component (A) is a compound of the formula I



in which:

M is a transition metal of groups 4 to 12 of the Periodic Table,

R¹-R⁹ are hydrogen or organosilicon or organic substituents having from 1 to 30

C atoms, it being possible for two geminal or vicinal radicals R¹ to R⁹

radicals also be connected to form a 5- or 6-membered ring, and it being

possible, when m is 2, for an R¹-R⁹ radical of in each case one

triazacyclohexane ring to form together with a substituents on the other

triazacyclohexane ring a bridge between the two rings,

X is fluorine, chlorine, bromine, iodine, hydrogen, C₁-C₁₀-alkyl, C₆-C₁₅-aryl

or alkylaryl having from 1 to 10 C atoms in the alkyl radical and from 6 to

20 C atoms in the aryl radical, trifluoroacetate, BF₄⁻, PF₆⁻ or bulky

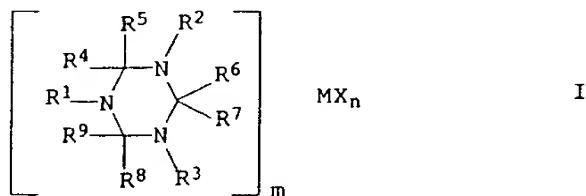
noncoordinating anions,

m is 1 or 2,

n is a number from 1 to 4 which corresponds to the oxidation state of the

transition metal M.

3. (canceled)
4. (currently amended) A process as claimed in ~~claim 3~~ claim 1, wherein M is a transition metal of group 6 of the Periodic Table.
5. (previously presented) A process as claimed in claim 1, wherein mixtures of ethylene with C₃–C₈- α -olefins are employed as monomers.
6. (canceled)
7. (canceled)
8. (currently amended) A process as claimed in ~~claim 3~~ claim 1, wherein at least one of the radicals R¹, R² or R³ is different from the other radicals in this group.
9. (currently amended) A catalyst for polymerizing olefins, comprising at least one transition metal complex (A) as defined in claim 1 and a support material and, if desired, one or more aluminoxane activator compounds (B).
10. (previously presented) A process for polymerizing or copolymerizing olefins wherein the polymerization or copolymerization is carried out in the presence of a catalyst as claimed in claim 9.
11. (previously presented) A transition metal complex of the formula I



in which:

M is a transition metal of groups 4 to 12 of the Periodic Table,

R¹-R⁹ are hydrogen or organosilicon or organic substituents having from 1 to 30 C atoms, it being possible for two geminal or vicinal radicals R¹ to R⁹ radicals also be connected to form a 5- or 6-membered ring, and it being possible, when m is 2, for an R¹-R⁹ radical of in each case one triazacyclohexane ring to form together with a substituents on the other triazacyclohexane ring a bridge between the two rings,

X is fluorine, chlorine, bromine, iodine, hydrogen, C₁-C₁₀-alkyl, C₆-C₁₅-aryl or alkylaryl having from 1 to 10 C atoms in the alkyl radical and from 6 to 20 C atoms in the aryl radical, trifluoroacetate, BF₄⁻, PF₆⁻ or bulky noncoordinating anions,

m is 1 or 2,

n is a number from 1 to 4 which corresponds to the oxidation state of the transition metal M,

wherein at least one of the radicals R¹, R² or R³ is different from the other radicals in this group.

12. (previously presented) A transition metal complex of the formula I as defined in claim 11, wherein m is 2 and one radical R¹-R⁹ of one triazacyclohexane ring together with one of these substituents of the other triazacyclohexane ring forms

a bridge between the two rings.

13. (canceled)
14. (previously presented) A process as claimed in ~~claim 3~~ claim 1, wherein m is 2 and one radical R¹–R⁹ of one triazacyclohexane ring together with one of these substituents of the other triazacyclohexane ring forms a bridge between the two rings.
15. (previously presented) A process as claimed in claim 1, wherein the transition metal is selected from group 6 of the Periodic Table.
16. (previously presented) A process as claimed in claim 1, wherein the transition metal is titanium, zirconium, hafnium, vanadium, chromium, molybdenum, tungsten, manganese, iron, rhodium or nickel.